

SOLICITATION FOR FINANCIAL ASSISTANCE APPLICATIONS

SOLICITATION NUMBER DE-PS36-00GO10480



AGENDA 2020 - FOREST PRODUCTS INDUSTRIES OF THE FUTURE

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I. INTRODUCTION

A. Background:

In 1994, the American Forest & Paper Association (AF&PA) released "Agenda 2020: A Technology Vision and Research Agenda for American's Forest, Wood and Paper Industry," which outlines the research needs of the forest products industry to allow it to pursue a sustainable future. Also at this time, the AF&PA and the Department of Energy (DOE) signed an agreement to collaborate on the implementation of the AF&PA's identified research agenda that falls within DOE's Office of Industrial Technology programmatic objectives.

In 1996, the industry organized a process, under the aegis of the AF&PA Chief Technology Officers (CTO) Committee, to assist DOE in identifying research projects most important to the industry's Agenda 2020 Vision. Six areas appropriate for research were established: sustainable forestry, environmental performance, energy performance, capital effectiveness, recycling, and sensors and control. Industrial Task Groups were organized, reporting to the CTO Committee, to work with the federal Government to implement research programs in these six areas. Annually, a portion of the group of six areas is included in a DOE-sponsored solicitation (limitations on funding availability do not allow all six areas to be included each year), with the Task Groups establishing research priorities within each of the included areas. Competitive solicitations in these annually selected research areas have been processed, resulting in approximately ninety (90) projects to date that have been identified and received DOE funding. Recipients of these awards have collaborated with universities, research institutes, DOE national laboratories, and industry associations in their research activities, a practice which is highly encouraged.

For additional information on Agenda 2020, refer to the DOE or Agenda 2020 websites at www.oit.doe.gov/forest or www.Agenda2020.org.

B. Objective:

This current initiative is to acquire research proposals in three of the six Task Group research areas identified above, including sustainable forestry, capital effectiveness, and sensors and control. The objective of this Solicitation is to select from applicants submitting a 2-page technical proposal, in accordance with the procedures described below, for these three areas.

C. Solicitation Definitions

"Applicant" means the legal entity or individual signing the application. This entity or individual signing may be one organization or a single entity representative of a group of organizations (such as a consortium) that have chosen to submit a single application in response to this Solicitation.

"Application" or **"Proposal"** means the documentation submitted in response to this Solicitation.

"Assistance" means the money, property, services, or anything of value transferred to a applicant to accomplish a public purpose of support or stimulation authorized by Federal statute.

"Award" means the written documentation executed by a DOE Contracting Officer, after an Applicant is selected, which contains the terms and conditions for providing financial assistance to the applicant.

"Budget" means the cost expenditure plan submitted in the application, including both the DOE contribution and the applicant share.

"Budget Period" means an interval of time, specified in the award, into which a project is divided for budgeting and funding purposes.

"Consortium (plural consortia)" means the group of organizations or individuals that have chosen to complete and submit a single application in response to this Solicitation.

"Contracting Officer" means the DOE official authorized to execute awards on behalf of DOE and who is responsible for the business management and non-program aspects of the financial assistance process.

"Cooperative Agreement" means a financial assistance instrument used by DOE to transfer money or property when the principal purpose of the transaction is to accomplish a public purpose of support or stimulation authorized by Federal statute, and substantial involvement is anticipated between DOE and the applicant during the performance of the contemplated activity.

"Cost Sharing" means the respective share of total project costs required to be contributed by the Applicant and by DOE. The required percentage of applicant cost share is to be applied to the total project cost (i.e., the sum of Applicant plus DOE cost shares) rather than to the DOE contribution alone.

"Financial Assistance" means the transfer of money or property to an applicant or subapplicant to accomplish a public purpose of support authorized by Federal statute through grants or

cooperative agreements and subawards. In DOE, it does not include direct loans, loan guarantees, price guarantees, purchase agreements, Cooperative Research and Development Agreements (CRADAs), or any other type of financial incentive instrument.

"Key Personnel" means the individuals who will have significant roles in planning and implementation of the proposed project.

"Participant" means any entity substantially involved in a consortium, or other business arrangement (including major subcontractors), responding to this Solicitation.

"Project" means the set of activities described in an application, State plan, or other document that is approved by DOE for financial assistance (whether or not such financial assistance represents all or only a portion of the support necessary to carry out those activities).

"Project Period" means the total period of time indicated in an award during which DOE expects to provide support contingent upon satisfactory progress and available funds. A project period may consist of one or more budget periods and may be extended by DOE.

"Applicant" or **"Proposer"** means the organization, individual, or other entity which receives an award from DOE and is financially accountable for the use of any DOE funds or property provided for the performance of the project, and is legally responsible for carrying out the terms and conditions of the award.

"Selection" means the determination by the DOE Selection Official that negotiations take place for certain projects with the intent of awarding a Cooperative Agreement.

"Solicitation" means a document which requests the submission of applications for support and which describes the objectives, applicant and project eligibility requirements, desired performance activity, evaluation criteria, award terms and conditions, and other relevant information about the opportunity.

"Substantial Involvement" means involvement on the part of the government that includes direction which the Applicant is required to follow. Such involvement will be negotiated with each Applicant prior to signing any agreement.

"Total Project Cost" means all the funds required to complete the effort proposed by the Applicant, including DOE funds plus all other funds that will be committed by the Applicant as cost sharing.

II. GENERAL INFORMATION

A. Solicitation and Amendments

Applicants are encouraged to obtain the Solicitation electronically through the Golden Field Office Home Page at <http://www.eren.doe.gov/golden/solicit.htm>. This Solicitation may also be requested by writing to: Beth H. Peterman, DOE Golden Field Office, 1617 Cole Boulevard, Golden, Colorado 80401-3393. Facsimiles can be transmitted to (303) 275-4788 to the attention of Beth H. Peterman, and electronic mail can be transmitted to beth_peterman@nrel.gov. Amendments, if any, to this Solicitation will be mailed to each requestor or may be obtained electronically through the Golden Field Office Home Page at <http://www.eren.doe.gov/golden/solicit.htm>.

B. Time and Place for Submission of Proposals

Proposals are due at 3:00 PM Mountain Daylight Time, on November 15, 1999. Proposals must be addressed to: U.S. Department of Energy, Golden Field Office, ATTN: Beth H. Peterman, 1617 Cole Boulevard, Golden, Colorado 80401-3393. An application received after the aforementioned date shall be considered a late submission and not eligible for consideration unless it: (a) was sent by first class, Registered or Certified Mail, or by U.S. Postal Service Express Mail Next Day Service-Post Office to Addressee, was postmarked not later than the application due date specified above (PRIVATE METERED POSTMARKS ARE NOT ACCEPTABLE PROOF OF THE DATE OF MAILING) and is received before the evaluation of all acceptable proposals submitted in response to the Solicitation.

If hand carried, proposals must be delivered to 1617 Cole Boulevard, Building 17, Room 351-11, Golden, CO 80401-3393 by the aforementioned time and date. The Applicant's courier must complete, sign, and have signed by the DOE person accepting the application, a receipt that will be available from DOE. Failure to complete the receipt shall render the application late and subject to the application deadline provision as stated above (10 CFR Part 600.8(a)(10)).

C. Questions Concerning this Solicitation

ALL questions concerning this Solicitation must be submitted, in writing, to the Contracting Officer, Beth H. Peterman, DOE Golden Field Office, 1617 Cole Boulevard, Golden, CO 80401-3393, or transmitted via facsimile to Beth H. Peterman at (303) 275-4788, or electronically to beth_peterman@nrel.gov. Responses to questions will be made by Amendment to the Solicitation, and posted on the websites.

D. Award Instrument

It is DOE's intention to ultimately award Cooperative Agreements to successful Applicants. The Cooperative Agreement was chosen because: (a) the principal purpose of the anticipated relationship is the transfer of money, property, services, or anything of value to a selected applicant in order to accomplish a public purpose of support; and (b) substantial involvement between DOE and the selected applicant(s) during the performance of the project is anticipated.

A sample cooperative agreement may be obtained at the Golden Field Office Home Page at www.eren.doe.gov/golden/solicit.htm. Appropriate intellectual property provisions will be negotiated and incorporated in any resulting agreement as determined by the Applicant's status (small business, large business, non-profit, etc.) and the particular project.

If an application is submitted by a consortium, or other business arrangement with more than one participant, the participants must decide how they will be structured (prime contractor with subcontractors or establish a separate legal entity) such that DOE can issue the award to a single entity. Negotiation, award, and administration will be in accordance with DOE Financial Assistance Rules (10 CFR Part 600).

E. Cost Sharing, Available Funding, and Eligibility

Only proposals submitted with the following minimum cost share requirements will be considered against this Solicitation:

- (1) For research projects to determine concept feasibility, a 20% minimum cost share from non-federal sources (i.e., Agenda 2020 funding from DOE will provide only 80% of the total project costs, at most.)
- (2) For projects that are in the development phase, with a proven feasibility, a 30% minimum cost share from non-federal sources.
- (3) For projects involving commercial demonstration of technologies, a 50% minimum cost share from non-federal sources.

Cost share contributions need not be monetary. In-kind contributions (e.g., contributions of services or property, donated equipment, buildings, or land, donated supplies, or unrecovered indirect costs) incurred as part of a project may be considered as all or part of the cost share as described under 10 CFR Part 600, Section 600.123. All Participant cost sharing must come from non-Federal sources (i.e., private, state or local Government, or any other sources that were not originally derived from Federal funds). Industrial and/or supplier involvement and cost sharing above the required minimums are strongly encouraged.

Fiscal Year 2001 DOE funding for this Solicitation is estimated to be \$2 million for new awards, depending on funding availability. Based on prior year results, the typical project size has been approximately \$200,000 per year for three years. DOE reserves the right to fund, in whole or in part, all or none of the applications ultimately submitted. DOE will not reimburse applicant costs incurred prior to selection announcement.

Proposals are encouraged from universities, small businesses, suppliers to the forest products industry, and other institutions. Member companies of the AF&PA are not eligible for funding, but are encouraged to participate in proposed projects as cost-sharing partners.

Proposals can include DOE national laboratory partners with unique capabilities, but the proposal should be structured so that the national laboratory receives funding directly from DOE. The cost share for the project should, however, be based on a total project cost including the funding requested for the national laboratory.

F. EAct Eligibility Requirements

Subject to the restrictions contained in 10 CFR Part 600.7(c), and the following limitations set forth in Public Law 102-486, applications from all sources will be considered. All Applicants selected for an award shall complete an EAct Certification. Based on the information provided, a determination by DOE that the EAct eligibility requirements are met shall be made prior to the award of a Cooperative Agreement. In accordance with Section 2306 of the Energy Policy Act of 1992 (EAct), Public Law 102-486, 42 U.S.C. 13525, the Participants of a successful application will be eligible to receive financial assistance only if:

- 1) participation in the project would be in the economic interest of the United States, as evidenced by:
 - a) investments in the United States in research, development, and manufacturing (including for example, the manufacture of major components or subassemblies in the United States);
 - b) significant contributions to employment in the United States; and
 - c) an agreement with respect to any technology arising from assistance provided under this section to promote the manufacture within the United States of products resulting from that technology (taking into account the goals of promoting the competitiveness of United States industry), and to procure parts and materials from competitive suppliers;

AND

- 2) either the Applicant is:
 - a) a United States owned company or entity; or
 - b) incorporated in the United States and has a parent company which is incorporated in a country which affords to United States-owned companies or entities: (1) opportunities, comparable to those afforded to any other company or entity, to participate in any joint

venture similar to those authorized under this Act; (2) local investment opportunities comparable to those afforded to any other company or entity; and (3) adequate and effective protection for the intellectual property rights of the United States owned companies or entities.

G. Sub-Awards to Debarred and Suspended Parties

Applicants and Participants, at any tier, must not make any subaward or permit any subaward (subcontract) to any party which is debarred, suspended, or is otherwise excluded from or ineligible for participation in Federal Assistance programs under Executive Order 12549, "Debarment and Suspension" or is otherwise ineligible hereunder.

H. Financial Assistance for Application Preparation

No funding will be available under the DOE Minority Economic Impact (MEI) loan program for preparation of applications in response to this Solicitation. DOE assumes no responsibility for any costs associated with application preparation or submission of applications if an award is not made.

I. National Environmental Policy Act (NEPA) Requirements

Prior to an award, all Applicants shall complete an Environmental Checklist. The Environmental Checklist is a series of questions designed to gather information in the following general areas as related to the proposed project: chemicals, waste generation, emissions, permitting, natural resources, and any unique or controversial issues. The requested information will be used by the DOE Golden Field Office (GO) to evaluate any potential impacts (positive and negative) on the environment, and must be in enough detail for the Department to meet its requirements under NEPA.

Applicants are restricted from taking any irreversible action prior to DOE/GO reaching a final NEPA decision regarding the proposed project. Irreversible actions include demolition of existing buildings, site clearing, ground breaking, construction, and/or detailed design. This restriction, however, does not preclude the Applicant from developing plans, preliminary designs, or performing other necessary support work prior to DOE/GO reaching its final NEPA decision, provided the work has been authorized by DOE.

J. Notice Regarding Eligible/Ineligible Activities

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned, or pending legislation.

K. Lobbying Restrictions

The contractor or awardee agrees that none of the funds obligated on an Award shall be made available for any activity or the publication or distribution of literature that in any way tends to promote public support or opposition to any legislative proposal on which Congressional action is not complete. This restriction is in addition to those prescribed elsewhere in statute and regulation.

L. Compliance With Buy American Act

In accepting an Award, the Recipient agrees to comply with sections 2 through 4 of the Act of March 3, 1933 (41 U.S.C. 10a. - 10c., popularly known as the "Buy American Act"). The Recipient should review the provisions of the Act to ensure that expenditures made under this Award are in accordance with it.

III. PROPOSAL PREPARATION PROCESS

ONLY a 2-page proposal for research in the areas identified in Section V is being requested by this Solicitation at this time. As also explained below, a further evaluation process will occur after review of these proposals. Each 2-page proposal should be prepared using the format found as Attachment 1 to this Solicitation. The size of each section of the 2-page proposal can be adjusted as needed, as long as the total length is not more than the 2 pages. The typed text should be no smaller than 12 point font. **Pages beyond the 2-page limit will not be reviewed and evaluated.**

After the Step 1 evaluation process, each applicant submitting a two-page proposal will receive written notification on the results of the review, and whether an additional, 5-page proposal should be submitted by March 1, 2000, for review. Based upon prior year results, approximately 30-40% of the 2-page proposals are selected by the Merit Review Committee for a more detailed review of a 5-page proposal. Each 5-page proposal should be prepared using the format found as Attachment 2 to this Solicitation. The size of each section of the 5-page proposal should be appropriate, as long as the total length is not more than 5 pages (pages in excess of the 5-page limit will not be reviewed), with attachments to the 5-page format not counting as part of the page count. The typed text should be no smaller than 12-point font. Only information provided in the 5-page proposal or as attachments can be considered in the evaluation process.

The Applicants selected to submit a 5-page proposal may be invited to participate in a one-day poster session tentatively scheduled for early February, 2000, where they may have the opportunity to elaborate on their research, interact with the industry representatives, and explore possible collaboration with other researchers. The poster session, if held, is likely to be in Atlanta, Georgia.

IV. EVALUATION OF PROPOSALS

Proposals will be reviewed using a three-step technical evaluation process, followed by a two step programmatic evaluation/selection process. The appropriate Agenda 2020 Task Groups will perform the first two technical merit reviews of the 2-page and 5-page proposals, the CTO Committee will perform the third technical review, and DOE will perform the final two-step programmatic review/evaluation and selection process.

A. Step 1 - First Technical Review

In the first technical review, the 2-page proposals requested by this Solicitation will be evaluated by the appropriate Agenda 2020 Task Groups in accordance with to the following evaluation criteria (the requirements for preparation of the 2-page proposals are included in Section III of this Solicitation):

Feasibility (17.5 points) - The technical potential will be evaluated considering the responsiveness of the proposal to the priorities identified in Section V, "Research Areas for This Solicitation," and the feasibility of the proposal, i.e., whether it is based on sound scientific and engineering principles and on an understanding of the current state-of-the-art in the forest products industry.

Innovation (17.5 points) - The innovation will be evaluated either in terms of providing improved fundamental understanding that could lead to solving an important problem or suggesting a new approach to solving an important problem.

Benefits to the Industry (17.5 points) - Benefits include the potential for enhancing the economic competitiveness of the forest products industry and the potential for reducing the manufacturing environmental impacts of the domestic forest products industry.

Energy Benefits (30 points) - Energy benefits include the potential for the proposed technology to contribute to the reduction of the manufacturing energy consumption of the domestic forest and paper industries. **Proposals selected by DOE for funding are required to have significant energy benefits.**

Appropriate Degree of Collaboration (17.5 points) - Collaboration capabilities, especially with forest and paper products companies, will be evaluated considering the ability to assemble a multi-disciplined team with research experience and industrial industry and industrial supplier participation.

The reviewers will score each proposal on each of the above criteria for a maximum of 100 points. The evaluation criteria are weighted as indicated above.

B. Step 2 - Second Technical Review

The second step of the merit review process is an evaluation of the requested 5-page proposals by the appropriate Agenda 2020 Task Groups, using the following evaluation criteria (instructions for preparation of the 5-page proposals are found in Section III):

Quality of the Proposal (Scientific, Technical and Overall) (17.5 points) – The technical potential of the proposal will be evaluated considering the clarity, completeness, and adequacy of the statement of objectives. The technical merit and feasibility of the proposed work will also be evaluated. (Is it based on sound scientific/engineering principles and on an understanding of the current state of the art in the forest products industry?)

Probability of Meeting Objectives (17.5 points) - The adequacy and appropriateness of the schedule (sequence of project tasks, planned levels of data acquisition, sampling and analysis, principal milestones, decision points, and time for each task) and the planned assignment of responsibilities and level of manpower to complete each task will be evaluated.

Quantified Benefits to the Industry (17.5 points) - The potential for enhancing the economic competitiveness of the forest products industry and the potential for reducing the manufacturing environmental impacts of the domestic forest products industry will be evaluated. The environmental benefits will be evaluated based on the data provided in the OIT Performance Metrics, Attachment 4.

Quantified Energy Benefits to the Industry (30 points) - The energy benefits will be evaluated considering the potential for the proposed technology to contribute to the reduction of the manufacturing energy consumption of the domestic forest and paper industry. The energy benefits will be evaluated based on the data provided in the OIT Performance Metrics, Attachment 4. **Proposals selected by DOE for funding are required to have significant energy benefits.**

Appropriate Degree of Collaboration (17.5 points) – Capabilities will be evaluated considering the ability to assemble a multi-disciplined team with research experience, qualifications in the proposal subject area, and knowledge of past advanced developments in the proposed work area. Participant(s) facilities will be evaluated on the availability of equipment, laboratory and demonstration facilities, analytic support and other necessary resources for performing the work proposed. Project management methods will also be evaluated. In addition, industry and industrial supplier participation are encouraged.

The reviewers will score each proposal on each of the above criteria for a maximum of 100 points. The evaluation criteria are weighted as indicated.

C. Step 3 - Third and Final part of Technical Review

The Task Groups will provide ranked Step 2 proposals to the CTO Committee in May, 2000, for the third and final part of the technical merit review. The ranking will be based on the tally of scores from the Task Group reviewers. The CTO Committee will accept the technical reviews of the appropriate Task Groups and evaluate the proposals according to the following criteria, listed in order of importance:

1. Projects with highest industry leverage – Projects will be evaluated for the number of industry and industrial supplier partners, cost share and in-kind contributions from industry and industrial suppliers, and industry and industrial supplier letters of support.
2. Alignment with AF&PA strategy – The technologies that are supported from an industry perspective should be consistent with the industry's vision, Agenda 2020, and policy goals.
3. Balance across industry sectors – A balance of projects in the various forest products industrial processes including manufacture of wood products, wood drying, fiber supply, debarking, chipping, pulping, chemical recovery, bleaching, refining, washing, headbox, formation, wet end, pressing, drying, and water and air effluent systems.
4. Balance between research, development and commercial demonstration – A portfolio of near, mid, and long term projects is desired. While research is important to the long-term survival of the forest products industry, the portfolio should also include projects with near-term impacts.
5. Achieving a goal of moving towards a 50% portfolio cost share – Projects will be evaluated on their cost share percentage as appropriate to the project stage. Monetary cost share and cost share from industry and industrial supplier partners will be considered as more important than in-kind contributions or cost share from the proposer.

The CTO Committee will compile an overall technical merit ranking of the 5-page proposals in June, 2000.

D. Step 4 - DOE Program Policy Review

In the fourth step of the evaluation process, the DOE Office of Industrial Technologies forest products team will perform a program policy review and develop a list of recommended projects for the DOE Selection Official. The DOE Program Policy Committee will use the industrial merit review ranking as the basis for discussing projects to recommend for selection.

In making its final recommendations, the DOE Program Policy Committee will use the following criteria, listed in order of importance:

1. Quantified Energy Benefits to the Industry - The energy benefits will be evaluated considering the potential for the proposed technology to contribute to the reduction of the manufacturing energy consumption of the domestic forest and paper industry. The energy benefits will be evaluated based on the data provided in the OIT Performance Metrics, Attachment 4.
2. Quantified environmental and economic benefits – Proposals that have the potential to reduce negative environmental impacts and provide significant cost benefit are preferred. Proposals that also offer significant reductions in greenhouse gas emissions (carbon, perfluorocarbons) are particularly encouraged.
3. Industry involvement – Proposals must have documented industrial support of the proposal via letters of support provided as attachments. The letters of support must be from the forest products industry or from a supplier to the forest products industry. While the letters do not have to document a financial commitment to the proposal, letters that do document a financial commitment will be given preference.
4. Cost and schedule – The cost and schedule of the proposal may be the basis of selection between projects of relative importance. In making selection decisions, the apparent advantages of individual applicants will be weighed against the probable cost to the government to determine whether the proposal approaches are worth the probable cost difference.

The DOE Program Policy Committee will recommend proposals to the Selection Official.

E. Step 5 - Application of Program Policy Factors and Final Selection

The Selection Official will review the recommendations of the Program Policy Committee and apply the following program policy factors for final selection:

1. Applications are preferred that have the potential to save significant energy, to reduce negative environmental impacts, and provide significant cost benefits.
2. DOE desires to have a portfolio of research projects balanced with respect to industry process areas (i.e., manufacture of wood products, wood drying, fiber supply, debarking, chipping, pulping, chemical recovery, bleaching, refining, washing, headbox, formation, wet end, pressing, drying, and water and air effluent systems), long-term vs. short-term market penetration horizons, and short duration vs. long duration projects.
3. Appropriate cost and schedule (including total project cost compared to available DOE funding, appropriate minimum cost share as described above, and reasonableness of schedule).
4. Program and geographic diversity.
5. Availability of DOE funding.

Full applications will be required only for those projects selected by the DOE Selection Official for negotiation of awards. DOE will mail written notifications regarding projects selected for negotiation in mid-July, 2000, with instructions and forms for the full applications to be

submitted to the DOE Golden Field Office. Negotiation, award, and administration of awards for DOE-selected projects will be performed by the DOE Golden Field Office in accordance with DOE Financial Assistance Rules (10 CFR Part 600). Applicants selected by DOE for award will be required to provide quarterly status reports to DOE and the appropriate industrial Task Group. The appropriate Task Group will also review selected projects via an annual report and presentation each spring.

V. RESEARCH AREAS FOR THIS SOLICITATION

Three Agenda 2020 Task Groups are participating in this request: sustainable forestry, capital effectiveness, and sensors and control. The research areas of interest for each Group are described below.

A. SUSTAINABLE FORESTRY

Pre-competitive research is needed to support improvements in wood quality that will enhance energy efficiency and environmental performance in wood processing industries. For DOE consideration, this research must substantiate how enhancing wood quality may lead to increased energy efficiency in the handling and manufacturing processed for solid wood, pulp and paper products.

Research topics include:

Genetic and molecular processes - Research is needed on the genetic and molecular processes that control wood formation and wood properties. Identification and understanding of these processes will improve the ability to develop trees with superior wood properties through breeding and genetic engineering. Wood properties of particular interest include density, chemical composition, and fiber characteristics. Improvements of these properties will improve the energy efficiency of the wood pulping process and require less chemicals in chemical pulping processes.

Physiological processes - Research is needed to determine how wood formation and wood properties are affected by plant growth regulators- light, water, nutrients- and distance of transport from crown to bole. Such research will support development of silvicultural systems that optimize wood quality as well as quantity. Improved wood quality reduces energy consumption per ton of paper produced.

Transition from juvenile to mature wood - Intensive management practices can substantially increase the growth rate of commercial tree species. Fast growing trees typically have a relatively large core of juvenile wood which can affect utilization. Juvenile wood is generally less desirable for lumber and has both advantages and disadvantages in paper making. Research is needed to better understand the efficiency

impact of using wood from fast growing trees in the manufacture of solid wood, pulp and paper products.

Effects of intensive management - Research is needed to better understand the effects of intensive management on wood properties in the manufacture of solid wood, pulp and paper products, including possible interactions with site variables and tree genetics. Wood properties of interest include physical and chemical properties of both juvenile and mature wood, as well as the relative amounts of juvenile and mature wood.

Models of desirable wood properties - Forest managers face changing markets for their timber. Wood properties that enhance timber values in some markets may be much less desirable in other markets. Research is needed to better define the value of various wood properties under alternative assumptions about end uses and processing technologies. Value should be expressed in energy, economic and environmental terms.

B. CAPITAL EFFECTIVENESS

A team of people from industry and research has been seeking to bring strategic focus to this complex area. This team has developed a concept of looking at capital from a total standpoint, considering the entire "life cycle" of the investment. This outlook led to a model of 3 strategic focus areas. Two of these lend themselves to efforts in Pre-competitive research, and these two are covered below:

- **Systems and Process Technologies (what is built)**
- **System Fabrication and Construction (how it is built)**

The Capital Effectiveness team met in May of 1999, with the specific goal of identifying the areas of greatest potential value, and defining where the greatest gaps exist between current practice and theoretical limits in the areas described above.

It was decided that substantial opportunities exist in System and Process Technologies and System Fabrication and Construction (including Project Management Cost Effectiveness.) Detailed descriptions of the Systems and Process Technologies gaps were developed and are attached in tabular and diagrammatic form. Potential gaps between ideal and actual practice measure in the billions in some cases. In many cases, the calculated savings are the result of improved thermal efficiency or energy use reduction.

It is our intention to support research and development work in areas that address these described areas of opportunity and that will have the greatest significance to the long-term success of our industry.

Area 1 - Paper and Board Manufacture

Using the “top quartile vs. theoretical” analysis, priority will be given to work that holds the greatest potential value and greatest probability of success.

<u>Top 25% of Industry Performance vs. Theoretical</u>		<u>Opportunity Gap</u>	<u>Very Approximate Gap Value</u>
1	<div> <div>45</div> <div>70</div> <div>Press Solids</div> </div>	25 Points	\$2.0 billion/yr
2	<div> <div>5 lb H₂O/hr/ft²</div> <div>15 lb/hr/ft²</div> <div>Drying Rate</div> </div>	10 lb/H ₂ O/ft ²	2x to 3x speed increase
3	<div> <div>90</div> <div>97</div> <div>Sheet Uniformity (e.g., 2 mm BW var.)</div> </div>	7%	\$3.5 billion/yr
4	<div> <div>Approx 80</div> <div>100%</div> <div>Fiber Utilization (Engineered Structure)</div> </div>	Approx. 20%	\$1.0 billion/yr
5	<div> <div>180 min</div> <div>30 min</div> <div>Delignification Time</div> </div>	150 Minutes	6x increase thru digesters
6	<div> <div>OD +1</div> <div>SW 4</div> <div>HW 3</div> <div>2</div> <div>Bleach Plant Stages</div> </div>	1-3 Stages	\$2.4 billion of capital over 30 yrs
7	<div> <div>85</div> <div>100</div> <div>Project Management Cost Effectiveness (including system fabrication and construction)</div> </div>	15 %	\$1.8 billion capital/yr

1. The gap applies to all 100 million tons. Closing the gap means approximately 40% less water to be evaporated. The assumed drying cost per ton of paper is \$50. This benefit is all energy savings.

$$\text{Benefit} = 100 \text{ million tons/year} \times 40\% \times \$50/\text{ton} = \$2 \text{ billion per year}$$

2. This could be expressed as a reduction in capital for all new and rebuilt machines in the United States. There is a concurrent energy savings on items not built which needs to be estimated.

3. This could result in an annual savings of 7% of the fiber used at a typical price of \$500/t. There are other ways to take the benefit. Energy savings on the 7% of fiber not made needs to be estimated.

$$\text{Benefit} = 100 \text{ million tons/year} \times 7\% \times \$500/\text{ton} = \$3.5 \text{ billion per year}$$

4. Engineered structures could result in the use of 20% more hardwood in 50% of the grades. Hardwoods require approximately 10% less energy. The historical cost difference between hardwood and softwood is \$100/ton (this compresses with lower pulp price).

$$\text{Benefit} = 100 \text{ million tons/year} \times 20\% \times 50\% \times \$100/\text{ton} = \$1 \text{ billion per year}$$

This benefit can also be taken by using more filler and fewer fibers, which can have a greater economic impact.

5. Delignification time includes ramp time. This could be expressed as a reduction in capital needed for digesters. Potential reductions in energy need to be estimated. There is a concurrent energy savings on items not built which needs to be estimated.

6. As bleach plants are rebuilt, this could eliminate two stages in each of the approximately 100 bleach plants in the U.S.; each stage (with washing) costs about \$12 million. There is a concurrent energy savings on items not built which needs to be estimated.

$$\text{Capital Benefit} = 100 \text{ bleach plants} \times 2 \text{ stages} \times \$12 \text{ million/stage} = \$2.4 \text{ billion (over 30 years)}$$

7. The "Business Case" paper shows annual capital spending of \$12 billion. Any potential reduction in energy needs to be estimated.

$$\text{Benefit} = 15\% \times \$12 \text{ billion} = \$1.8 \text{ billion capital per year}$$

Area 2 - Wood Products Manufacture

Top Quartile Performance vs. Theoretical

		<u>Opportunity Gap</u>	<u>Very Approximate Gap Value</u>
	6885		
1	Lumber Scanning and Grading Automation (impact on log yield)	17 %	\$270 MM/yr
	8998		
2	Structural Panel Edge Uniformity	9 %	\$30 MM/yr
	1.40.85		
3	Structural Panel Surface Modification (improved capital productivity)	0.55	\$660 MM/yr
	4575		
4	Wood Flake, Chip and Particle Drying (overall thermal efficiency)	30%	\$2.1 B/yr
	148		
5	Improved Wood Cutting (cutting cost/MBF)	\$6/MBF	\$170 MM/yr
	425F/180s275F/40s		
6	Reduced Temperature, Fast-Curing Resin Development (resin curing temp & time)	150F/140s	\$3.2 B

Assumptions:

Annual Domestic Lumber Production = 17.5 Billion Board Feet (Random Lengths);
 Annual Domestic Structural Panel Production = 29.9 Billion Square Feet (3/8 basis - Random Lengths).

Calculations for Gap Values

1 Lumber Scanning & Grading Automation

Premise: Increase average log yield from 68% to 85%

Assumption: MBF Lumber is worth \$90 more than MBF wood residue (L-P average)

The energy reserve increase in standing wood needs to be estimated.

$$(85\%-68\%) \times (17,500,000 \text{ MBF/yr}) \times \$90/\text{MBF} \approx \$270\text{MM}$$

2 Structural Panel Edge Uniformity

Premise: Increase "good edge" panels from 89% to 98%

Assumption: Total cost of "bad edges" is \$30/MBF of out-of-spec panels (L-P average)

There is an energy savings on the 9% of panels not made which needs to be included.

$$(98\%-89\%) \times (11,200,000 \text{ MBF/yr}) \times \$30/\text{MBF} \approx \$30\text{MM}$$

5 Improved Wood Cutting

There is an energy savings that needs to be estimated and included.

$$\$6/\text{MBF potential} \times (17,500,000 + 11,200,000) \text{ MBF/yr} \approx \$170\text{MM/yr}$$

C. SENSORS AND CONTROL

Efficient manufacture of wood and paper products requires effective control of production processes to achieve precision in operations and uniformity in products, and to minimize energy consumption. The Sensors and Controls Work Group identified a diverse set of needs that are required to accomplish the Agenda 2020 vision for the industry, grouped in five pathways as follows:

1. Actuators and control devices
Final control devices that reduce variability and enable efficient control
2. Measurement and diagnostics
Reliable, cost-effective sensors for critical process parameters
3. Process and product models
Optimal control facilitated by robust and accurate models
4. Data presentation, interpretation, and human interface
Systems that help human operators manage processes safely and efficiently
5. Control system effectiveness
Systems that achieve and sustain efficient operations.

Together, these pathways cover almost all aspects of process control systems. The Task Group for the past four years has emphasized sensor development in recommending projects for funding and in soliciting project proposals. The priority given to new sensors recognizes the inherent difficulties the industry faces in getting useful process measurements.

The members of the Work Group identify current priorities before new project proposals are requested. For the FY2001 project selection process, specific research areas are described below, listed in order of the pathways and not in order of importance. Research proposals that do not relate to the research areas will be evaluated, but the proposers must realize that project proposals in the research areas will receive more favorable attention.

Sensors and Control Research Areas

1. Devices that improve the ability to develop fiber and paper properties more precisely and uniformly with lower energy consumption (Pathway 1)

Reducing variability in manufacturing processes and paper products is an increasingly important focus in the pulp and paper industry. The industry is limited in its ability to control processes with enough precision because of limitations in control valves, mechanical adjustments, dampers, and other final control elements. Work in this area may include, for example, tools that achieve more uniform fiber refining than the existing refiner equipment used in the industry. Such a capability would enable a significant reduction in electric power consumption while maintaining product quality.

2. Nozzles that improve the uniformity of black liquor droplets to improve energy efficiency of chemical recovery boilers (Pathway 1)

Controlling droplet size is critical for improving operational efficiency of recovery boilers in kraft pulp mills. Improved boiler efficiency directly relates to reduced energy consumption.

3. On-line measurement of non-process elements at low concentrations for energy reduction and environmental benefit (Pathway 2)

This need is increasing in importance as mill water systems increase closure and reduce fresh water intake. Non-process elements can have negative impacts on process chemistry, scale formation, and energy efficiency. We can best adjust operating conditions to purge, dilute, or reduce the formation of these materials if real-time measures of their concentrations are available. Elements of importance include calcium, phosphorus, chlorine, manganese, magnesium, iron, and oxalate ions. These sensors are primarily for application in pulping, bleaching, and chemical recovery process areas. Sensors must operate reliably in harsh temperature and pH conditions with low maintenance requirements. Energy benefits can be achieved by reducing purge flows, fresh water usage, fouling of heat transfer surfaces, and undesired chemical reactions.

4. Cost-effective on-line sensors for pulp and fiber properties that facilitate papermaking with reduced energy consumption (Pathway 2)

Knowledge of pulp characteristics is critical to papermaking with minimal energy consumption and for the manufacture of products that consistently meet customer expectations for uniformity and performance. Properties of considerable interest for new sensors include fiber strength, bonding potential, fiber kink and curl, and levels of contamination of dirt and other undesirable components. Work is in progress on ultrasonic pulp characterization, but proposals that use other techniques are encouraged. The proposed research should offer opportunities to significantly reduce energy consumption in refining and/or papermaking, which are large consumers of electrical and steam energy.

5. In-digester, real-time measurement of pulping reactions for energy-efficient operation of batch and continuous digesters (Pathway 2)

Pulping reactions occur inside large pressure vessels called digesters. A non-intrusive technique for real-time knowledge of the degree to which pulping reactions have progressed would improve pulp uniformity and energy efficiency. Steam energy for pulping is a major energy need in a pulp and paper mill.

6. On-line identification and measurement of chemical species in low concentrations in paper machine white water systems to reduce paper mill energy use (Pathway 2)

This would be beneficial for improved control of paper properties and for better operational efficiency and lower energy consumption. Species of concern include calcium ions, sodium ions, dissolved wood solids, silicone, and dirt contaminants. The presence of such components can lead to process upsets and product rejects, both of which increase energy consumption in a paper mill.

7. Methods to quickly develop robust, multi-variable models for process control with optimal energy consumption and product quality (Pathway 3)

These multivariate approaches will employ fundamental understanding of key relationships in combination with statistical methods such as neural nets, and will offer continual updating and validation of the models. In addition, methods to employ the models in control systems are desired. Ease of use by relatively untrained engineers and low cost of implementation are important attributes. Proposals in this area must show how the methods are portable to multiple locations and not specific to a given mill. Development of useful methods is more important than demonstration of capabilities. Such methods would be useful, for example, in controlling papermaking process variables to reduce energy consumption while maintaining product quality. Another example involves dynamics of circulation and combustion in a chemical recovery boiler to improve boiler efficiency and increase steam generation.

8. Better methods for improving operator response to abnormal situations and upset conditions to assure energy-efficient operations (Pathway 4)

Effective alarm management is one aspect of this need. Expert system approaches for operator guidance or automated response under defined situations also is embodied in this need. The highest level of energy efficiency is achieved when process operations are stable. Reducing the portion of time that processes are not stable will improve energy efficiency.

9. Techniques that sustain effective performance of control systems to maintain energy efficiency (Pathway 5)

Methods to keep control systems operating near maximum effectiveness without degradation over time is an important need with large potential for economic and energy benefits. Systems more complex than conventional proportional/integral/derivative (PID) controllers too frequently require attention from control specialists to retune and modify control algorithms. The inability to sustain effectiveness long-term hinders the commercial implementation of advanced control systems in the paper industry and, therefore, energy consumption is greater than necessary. Proposals in this area should identify a specific process area where the research will be focused, but the approaches must be general enough to be applied readily to other industry process areas.

VI. SOLICITATION ATTACHMENTS

1. Two-page proposal format
2. Five-page proposal format
3. Detailed budget
4. OIT project performance metrics

**ATTACHMENT 1
TWO-PAGE PROPOSAL SUBMITTAL FORM**

PROJECT TITLE:

PRIMARY INVESTIGATOR AND COLLABORATORS:

(include full mailing address, phone, fax, e-mail, and congressional district for primary investigator)

RESEARCH AREA(S) IN THE RFP TO WHICH THIS WORK IS FOCUSED:

BACKGROUND:

OBJECTIVES:

ATTACHMENT 1 (cont.)
TWO-PAGE PROPOSAL SUBMITTAL FORM

GENERAL EXPERIMENTAL APPROACH:

QUANTIFIED BENEFITS TO THE INDUSTRY SHOULD THE RESEARCH YIELD PROMISING RESULTS:

APPROXIMATE SCHEDULE AND MAJOR MILESTONES:

**APPROXIMATE BUDGET AND SOURCES OF FUNDING (Including Cost Sharing)
FOR EACH YEAR AND OVERALL:**

Budget	Total	DOE Request	Cost Share
Total Project			
Year 1			
Year 2			
Year 3.....			

ATTACHMENT 2 FIVE-PAGE PROPOSAL FORMAT

A summary page (one-page limit) should be provided in the following format using no smaller than a 12-point font type print. **This summary page is not included as part of the 5-pages.**

Agenda 2020 Research Area: (i.e., sustainable forestry, capital effectiveness, or sensors and control. Also indicate whether proposed project is at research feasibility, development or commercial demonstration phase; See Section II, E.)

Project Title:

Principle Investigator: (include name, organization, mailing address, phone number, fax number, e-mail, and congressional district)

Partners: (company names, mailing address, congressional district)

Abstract: (2-3 sentences that could be used for a press release)

Budget Table:

Budget	Total	DOE Request	Cost Share
Total Project			
Year 1			
Year 2			
Year 3			

The 5-page portion of the proposal must include the following main headings:

1. Project Title
2. Primary Investigator - name, title, company
3. Collaborators - name, title, address, and congressional district
4. Research Area in the Solicitation to Which This Work Is Focused
5. Background
6. Objectives
7. Experimental Approach
8. Quantified Benefits to the Industry Should the Research Yield Promising Results
9. Schedule, Milestones, Go/No-go Decision Points, and Other Measures of Success Including a Path to Commercialization
10. Investigator's and Collaborators' Qualifications - include citations of investigators' key publications most directly related to proposed work (do not attach resumes, publications, or publication lists)
11. Budget - include funding level required in each project year using the format provided in Attachment 3. This can be provided as an attachment and will not count as part of the 5 pages.

The size of each section of the proposal should be appropriate provided, however, that the total length of this portion is not more than 5 pages. The following attachments **are required for DOE funding** and do not count as part of the 5 pages:

- Industry Letters of Support;
- Detailed Budget (see Attachment 3);
- OIT Project Performance Metrics Form (see Attachment 4);
- Documentation of previously stated appropriate level of cost share (in-kind contributions, such as donations of material and labor, are acceptable as cost share if realistic dollar values are assigned to such contributions; sunk costs, such as value of previous research, cannot be used for cost share).

If a proposal is selected for negotiation of an award and includes a DOE national laboratory participant with unique capabilities, the national laboratory will receive their funding directly from the DOE via the existing contract between DOE and the laboratory rather than as a subcontract or work-for-others agreement. The cost share for the project should be based on a total project cost including the funding requested for the national laboratory.

Baseline data to assist with the OIT Project Performance Metrics Form can be obtained by e-mailing your federal express address to smcqueen@energetics.com.

ATTACHMENT 3 DETAILED BUDGET

DOE Cooperative Agreements require the budget to be provided in the categories listed in the tables below. This information, submitted as an attachment to the 5-page proposal, will be used in proposal evaluation.

Total Budget	Total Project	DOE Request	Cost Share
Direct labor			
Fringe benefits			
Travel			
Equipment			
Supplies			
Contractual			
Construction			
Other direct			
Total Direct			
Indirect			
Total Project			

Annual Budget	Year 1 Total	Year 1 Request	Year 1 Cost Share	Year 2 Total	Year 2 Request	Year 2 Cost Share	Year 3 Total	Year 3 Request	Year 3 Cost Share
Direct labor									
Fringe benefits									
Travel									
Equipment									
Supplies									
Contractual									
Construction									
Other Direct									
Total Direct									
Indirect									
Total Project									

ATTACHMENT 4 OIT PROJECT PERFORMANCE METRICS

1. Technology Description

- A. Please provide a concise ***narrative description*** (no more than one-half page) of the new technology you are proposing, addressing:
- Its function, and benefits to the industrial user of the technology
 - The state-of-the-art technology it replaces
 - The goal(s) of the project
 - Potential limitations or barriers to the technology's application
 - Plant modifications necessary to incorporate the technology (will the technology retrofit an existing system or totally replace existing technology?)
 - Known competing technologies (current or emerging)
- B. Define ***one unit-year*** of operation (What is a typical process unit? What is the typical unit capacity? (e.g., tons/year/unit, million Btu/year/unit, size of one plant or process using the new process/equipment/model, etc.))
- C. Estimate the ***equipment lifetime*** (in years)
- D. Will using the technology/process involve a ***retrofit*** of existing technology/process or a ***replacement*** of a unit operation or plant section? (***please explain***)
- E. Estimate the ***initial capital cost*** (equipment + installation) of one ***new*** technology unit and one ***current*** technology unit
- F. Estimate the annual ***non-energy variable costs*** associated with the ***new*** and ***current*** technology units.

2. Market Assessment

- A. Estimate ***number of installed units in U.S. market*** (total number of units or applications that are currently in use)
- B. Estimate ***ultimate potential market share*** (the maximum size of the market, as a percentage, in which the technology or process would be applicable)
- C. Estimate the ***likely technology market share*** (the percentage of the potential market that the technology is likely to capture, given competing technologies, etc.)

D. Estimate the *year of commercial introduction* (the year in which you expect the first unit to be in commercial operation)

E. Estimate the *time to total market saturation* (5 to 40+ years)

3. Energy Consumption (*per unit-year of operation*)

Please complete the following table, basing your estimates on **one unit-year** of operation. As indicated below, physical units are preferred, but you may also provide your estimates in terms of Btu consumed (PLEASE NOTE UNITS AND UNIT SIZE FOR EACH FUEL TYPE, IF DIFFERENT FROM THAT SHOWN IN TABLE).

Fuel Type	New Technology	Current Technology	Comments
Annual Unit Energy Use (in physical units)			
Electricity (million kWh)			
Natural Gas (million cubic feet)			
Petroleum (million barrels)			
Steam Coal (million short tons)			
Black Liquor (thousand tons)			
Other (please specify)			

4. **Non-Energy Related Environmental Impacts** (*per unit-year of operation*)

Please complete the following table, basing your estimates on **one unit-year** of operation.
(PLEASE NOTE UNITS AND UNIT SIZE FOR EACH EMISSION TYPE, IF DIFFERENT FROM THAT SHOWN IN TABLE).

Non-combustion Related Emissions	New Technology	Current Technology	Comments
Annual Non-Combustion Related Emissions (metric tons/unit-year)			
CO ₂ (expressed as metric TCE)			
Other greenhouse gases (CH ₄ , HFCs, CFCs)			
SO ₂			
NO _x			
Particulates			
VOCs			
Hydrocarbons			
CO			
Toxic (TRI) (please specify)			
Hazardous (non-TRI) (please specify)			
Non-Hazardous Solid Waste (RCRA) (please specify)			
Other (please specify)			

TCE = tons carbon equivalent ($44\text{CO}_2/12\text{C}$)